INTEGRATED ENVIRONMENTAL HEALTH IMPACT ASSESSMENT OF DISINFECTION BY-PRODUCTS

James Grellier, *Department of Epidemiology and Biostatistics, Imperial College London, United Kingdom*
Lesley Rushton, *Department of Epidemiology and Biostatistics, Imperial College London, United Kingdom*
Mark J Nieuwenhuijsen, *Centre for Research in Environmental Epidemiology (CREAL), IMIM, CIBERESP, Barcelona, Spain; Department of Epidemiology and Biostatistics, Imperial College London, United Kingdom*
David J Briggs, *Department of Epidemiology and Biostatistics, Imperial College London, United Kingdom*

Background and Aims: Disinfection by-products (DBPs) in drinking water are associated with several health outcomes. Impact assessment of DBPs is dominated by unitary approaches relying on monitoring data and toxicological estimates of dose-response. This study aimed to carry out an integrated environmental health impact assessment (IEHIA) of DBPs that took into account the full chain between environmental drivers of DBP formation (organic carbon in surface water) and health impacts, under contrasting climate change scenarios.
Methods: The assessment was carried out for two UK regions for which land use scenarios had been previously developed for 2051. A regression model was constructed and validated using dissolved organic carbon (DOC) monitoring data. A published water balance model was modified and combined with the regression model, and DOC concentrations were estimated under each scenario. Estimates of total trihalomethane (TTHM) concentration were generated using laboratory-based models. Exposure-response functions (ERF) were derived from meta-analysis (SGA) and pooled analysis (bladder cancer). Health impacts were computed probabilistically, by applying the ERFs to projections of population and rates of disease.
Results: Estimated health impacts in the two study areas for SGA and bladder cancer increased under both climate scenarios relative to a 2001 baseline. Increases were greatest in the region where surface water is primarily used as a source: attributable cases of bladder cancer increased by 60-70%; cases of SGA increased by around 35%. The low emissions scenario yielded smaller impacts, but any health benefit from adopting low emission policies was small: in the order of a 20% reduction of cases of bladder cancer and 9% of SGA in the high surface water use region.
Conclusions: IEHIA was applied for the first time to DBPs, a systemic risk factor in drinking water. Modelling of the full chain produced estimates of health impacts under future climate scenarios.